PROJECT NUMBER : 1812
PROJECT TITLE : New Expanded Tobacco
PROJECT LEADER : E. B. Fischer
PERIOD COVERED : July, 1991

I. BATCH GASEOUS CO_2 IMPREGNATION

A. **Objective:** Define process parameters for a batch gaseous CO_2 impregnation process.

B. **Results:** Improvements to the gaseous CO_2 impregnation cycle at the Bermuda Hundred facility were successfully implemented resulting in further reductions in the total cycle time. The CO_2 flow rate during the cooling step was successfully increased to 1000 lbs/min without adverse affects on the bed temperature uniformity or bed pressure drop. At this flow rate, target bed temperatures were achieved within 6 to 7 minutes resulting in a total time under pressure of approximately 22 minutes. The depressurization step took 10 of the total 22 minutes and was rate limited by the existing recovery compressor in Module 3. With the properly sized equipment for this recovery step and a loading and unloading duration of approximately 15 minutes, a total cycle time of approximately 33 minutes to meet the targeted 5000 lbs of expanded tobacco per hour is achievable.

Gaseous CO_2 impregnation trials at 950 psig were completed to determine if this operating path will successfully yield a shorter cycle time. For these trials, the tobacco bed was cooled to a temperature of approximately 20 °F by flowing CO_2 gas through the bed at 400 psig. The target post-vent bed temperature of approximately 0 °F was not achieved using this operating path. Final post-vent bed temperatures ranged from +10 to +20 °F which resulted in a relatively unstable impregnated filler.

Testing was conducted to evaluate the effect of primary processing parameters including cutting OV, cutting temperature, cut width, and sugar casing on filler size feeding the NET process. Results indicated that there were no major differences in sieve size for any of the variables except cutting OV where a cutting OV of 24-25% was best. In addition, testing was completed to compare the survivability of 25 vs. 30 cpi through the NET process. The filler with 25 cpi consistently showed improved survivability over 30 cpi.

C. **Plans:** A series of 5 consecutive runs with 15% OV tobacco and 800 psig impregnation pressure is planned using the current operating cycle to establish the effects of continuous operations on temperature profiles and impregnation.

IV. CHEMICAL STIFFENING

A. Objective: Define a process to chemically stiffen expanded tobacco which will reduce thermal treatment and the associated subjective degradation while maintaining cigarette filling power equivalent to the current process.

B. Results: As a means to reduce the concentration of the acetate anion on the tobacco, a calcium acetate/bicarbonate mixed salt was evaluated on tobacco expanded in the 8" DIET pilot plant. It produced expanded tobacco with a 1.6 cc/g CV improvement over the control. These results are similar to those from samples treated with calcium acetate or calcium propionate. Based on these results a subjective evaluation of these additives is being planned to determine which additives show promise for further development and optimization.

C. Plans: Determine the acid removal profiles for the additives. Evaluate the effect of pH adjustment of the additive solutions on CV results and acid removal profiles. Prepare samples for subjective evaluation including reduced acid products.

V. PRODUCT DEVELOPMENT AND EVALUATION

A. Objective: To optimize both the physical and subjective characteristics of the NET process and to evaluate the inclusion of the various NET product options into present and future brands.

B. Results: Marlboro Ultra Lights and PM Lights were made for comparative testing using ET blends that were DIET processed and NET processed for parity with DIET. The cigarettes were evaluated internally by Flavor Development and determined to have subjective parity. Additional testing by the MC panel is being scheduled.

In support of Project Tomorrow, sugar cased bright #10, C34 burley, and MT were made into a variety of expanded products using the NET process. The products, which were supplied to Product Development for cigarette evaluations, ranged from those processed with low thermal treatment (best subjectives) to those processed for maximum filling power (2-3% tower exit OV).

Cigarette models containing Marlboro blends of 12%, 22%, and 32% expanded tobacco were evaluated with low thermal treatment (tower exit OV 6-7%) NET, Manufacturing DIET, Pilot Plant DIET, and unexpanded Bright #10. Compacimeter results indicated that models containing 12% DIET and 22% NET had equal tobacco weights at a constant 3.0 mm firmness. In addition, cigarettes containing 32% NET maintained the same puff count, static burn time, and nicotine delivery as Marlboro cigarettes with 12% MC DIET.

C. Plans: Continue testing to evaluate and demonstrate the benefits of NET processed tobacco.

II. CONTINUOUS IMPREGNATION PROCESSES

A. **Objective:** Develop a continuous impregnation process to improve the subjectives of expanded tobacco while maintaining equivalent cigarette filling power to the existing process.

B. **Results:** Work is continuing on the design and construction of a short cycle impregnation (SCI) pilot plant. The tobacco feed system for the SCI process has been defined and will consist of Rothmans' TWD feeders. Metering and tobacco degradation tests were successfully conducted at Rothmans in Canada. Based on the success of these tests two feed hoppers, two TWD feeders and controls have been selected for the pilot system. Bench scale tests were conducted to simulate tobacco transfer from the Rothmans' TWD to the impregnator. The results were used to establish charge tube and slide gate geometries for the feed system. A slide gate prototype was ordered to test the feeding of tobacco into the impregnator in less than three seconds.

The SCI pilot plant layout drawing and P&ID have been finalized. A critical path analysis of the project schedule is being conducted to improve the estimated start-up date of October 1991. Long delivery items have been identified and purchase orders have been initiated to expedite receipt of the equipment.

C. **Plans:** Finalize the sequence of operation and track the project progress against scheduled milestones.

III. EXPANSION AND REORDERING PROCESSES

A. **Objective:** Define alternate means of puffing, drying, setting, and reordering impregnated tobacco to improve product subjectives and physical characteristics relative to the present DIET process.

B. **Results:** The manufacturer of the spiral humid air reordering unit provided a new conveyor belt design for evaluation. Test results showed that the new design significantly improved tobacco handling. Work is continuing to optimize the performance of the reordering unit. Processing modifications to date have allowed expanded tobacco to be reordered from 3% OV exit the tower to 11.5% OV. Laboratory tests in environmental chambers have yielded results which indicate that with counter current flow a reasonable range of temperature and air velocities may be used to reorder tobacco without suffering a CV loss.

C. **Plans:** Continue testing to establish optimum operating conditions for humid air reordering in the spiral unit. Relate expanded tobacco product attributes to tower operating variables through 8" tower data analysis.